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Christensen, Jesper Lindgaard; Störring, Dagmara

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Clusterpreneurs – Promoting High-Tech Clusters in
Low-Tech Regions

By

Dagmara Stoerring and Jesper Lindgaard Christensen

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Dagmara Stoerring
European Parliament

Jesper Lindgaard Christensen
Aalborg University
Department of Business Studies
IKE, DRUID
Fibigerstræde 4
DK-9220 Aalborg Ø
E-mail: jlc@business.aau.dk

Abstract:

This paper discusses the feasibility and dilemmas in stimulating high-tech clusters in regions characterised by low-tech production. In the last decades cluster policy have become central features of policy promoting growth on both the regional, national and European level. Many regional and national government's policies are aimed at imitating the success of the well known clusters, such as Silicon Valley and others.

However, the effectiveness and appropriateness of transferring experiences from other regions is debatable. In particular, innovation policy is likely to be inefficient if a 'one-size-fits-all' approach is adopted (Tödtling and Trippl, 2005). It is essential that the policy approach takes into account the abilities of the region and the degree of systemic innovation in the regions, that is, to which extent institutions and actors are interlinked (Cooke, 2001). Peripheral regions and high-tech urban areas differ in this respect. Additionally, less favoured regions often have poorly developed social capital (Morgan, 1997), and often lack large firms work as drivers of clusters. This emphasizes the need to focus on the carriers of the cluster policy. When policy is to a large extent about stimulating collective learning processes and building social capital, then the key issues for policy become very much about human capital in both the 'supply' and 'demand' dimension.

Despite this importance of the role of policy actors, research in cluster development and even cluster policy has generally not emphasized a more precise specification of this role. This paper contributes to this debate by focusing on and substantiating the concept of "clusterpreneurs" defined as important actors in cluster formation. Thus, a clusterpreneur is here regarded as one or more key actors in a cluster emerging process. Key actors include research organisations, industry, and policy makers as developed in the Triple Helix literature (e.g. Etzkovitz and Leydersdorff, 2000) as well as venture Capital and access to specialised business services. One of the roles of clusterpreneurs is to link the elements together. One of the 'Quadra Helix' actors may dominate and drive the cluster development asymmetrically.

We illustrate the clusterpreneur-approach by the example of a biomedical technology cluster initiative in North Jutland, Denmark and point to the presence of at least three types of dilemmas connected with cluster policy aimed at promotion of high-tech clusters in low-tech regions. We show how the simultaneous presence of clusterpreneurs can make this initiative more legitimised, although dilemmas and challenges in the policy making still prevails. One is to stimulate social capital combined with the fact that less favoured regions often have structural and institutional disadvantages. On the other hand, in our case the previous establishment of another successful cluster within wireless telecom provided public clusterpreneurs with a will to replicate the past success. This rendered a mental and social proximity and agreements on common objectives reaching further than short-term unemployment problems in the region. However, we do see some problems in promotion of the Biomedical technology cluster in the region, the main one being reaching a critical mass of firms. Policy lessons are derived on this basis.

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1 Introduction¹

This paper discusses the feasibility and dilemmas in stimulating the development of high-tech clusters in regions characterised by low-tech production. In the last decades cluster initiatives² and -policy have become central features of policy promoting growth on both the regional, national and European level. Many regional and national government's policies aim at imitating successful clusters in the belief that their local areas may also capture the benefits of new high technology firm formation and expected economic growth (Cooke, 2001a). Both academic models (Brenner, 2004) and a number of consultant-made guidelines, even guide-books (e.g. DTI, 2004, Rosenfeld, 2002) have been developed to assist the policy decision process. This promotion of high-tech clusters is not confined to urban areas but also often takes place in periphery regions, such as in the example in this paper, the possible development of a Bio-medico cluster in the region of North Jutland in Denmark.

However, the effectiveness and appropriateness of transferring experiences from other regions is debatable. One precondition for success of cluster policy in periphery regions has been argued to be a degree of systemic innovation in the regions, which in turn implies that institutions and actors are interlinked (Cooke, 2001a). Thus, European Commission points out that

“It is not simply the presence of units of RTD infrastructure, but of the degree of interaction between them which is the most significant factor in local innovation. The quality of the linkage and the presence of local synergy is the key element. Therefore a systems or network approach provides the best basis for understanding and promoting regional RTD-based innovation” (CEC, 1988)

Morgan (1997) contends that less favoured regions often are not only less favoured in the traditional sense of poor physical infrastructure, higher unemployment rates, low income per head; but they also have poorly developed social capital³. Tödtling and Trippel (2005) argue that innovation policy is likely to be inefficient if a ‘one-size-fits-all’ approach is adopted. It is essential that the policy

¹ We would like to thank commentators on earlier drafts of the paper. Especially thanks to Mike Crone, Economic Research Institute of North Ireland, Oakey, Hans Gullestrup, AAU, Pablo d'Este of SPRU and Tessa van der Valk, Utrecht University. Errors remain our responsibility.

² “The Cluster Initiative Greenbook” defines a cluster initiative as an organized effort to increase the growth and competitiveness of a cluster within a region, involving cluster firms, government and/or the research community (Sölvell, et al, 2003).

³ Morgan thus supports the OECD in

“Less favoured regions seem to have little or no social capital on which they can draw, a point which turns the spotlight on factors such as the institutional capacity of the region, the calibre of the political establishment, the disposition to seek joint solutions to common problems. These factors – the invisible factors in economic development – are just as important as physical capital” (OECD, 1993).

approach takes into account the abilities of the region and the degree of systemic innovation in the regions, that is, to which extent institutions and actors are interlinked. Peripheral regions and high-tech urban areas differ in this respect.

This emphasizes the need to focus on the carriers of the cluster policy. When policy to a large extent is about stimulating collective learning processes and building social capital, then the key issues for policy become very much about human capital in both the ‘supply’ and ‘demand’ dimension.

Despite this importance of human resources and the role of policy actors, research in cluster development and even cluster policy has generally not emphasized a more precise specification of this role. This paper contributes to this debate by focusing on and substantiating the concept of “clusterpreneurs” defined as important actors in cluster formation⁴. Thus, a clusterpreneur is here regarded as a key actor in the process of emergence of clusters. We argue that active clusterpreneurs are relatively more important in less favoured regions, and that different clusterpreneurs may act effectively in different institutional settings and in different phases of cluster evolution. The primary contribution of the paper is thus the combination of the actors perspective and the incorporation of regional specificities.

We illustrate the role of clusterpreneurs by the example of a biomedical technology cluster initiative in North Jutland, Denmark. This region has many characteristics of a peripheral one, thus, it is also a case of promotion of high-tech clusters in low-tech regions. The example could be said to be a typical case of a policy-driven cluster initiative. However, we show how the presence of clusterpreneurs comprising a set of different actors can make such an initiative more effective. Moreover, we claim that this region may deviate from the usual picture of less favoured regions having poor social capital and coherence. This may provide an important pre-condition for further development of the cluster.

We start with presenting the concept of clusterpreneurs: its origin, and main features. Then we discuss the nature of cluster policies: the principle difficulties for cluster formation in the periphery/low-tech regions; and we review theories on cluster emergence and cluster policies with a special emphasis on the relation between cluster policy and dilemmas related to implementing such policies in peripheral regions. We then describe specific difficulties in our case region of North Jutland in Denmark. Finally, our case of a Biomedico cluster initiative in North Jutland region

⁴ The concept of clusterpreneur was presented in the “The Cluster Initiative Greenbook” at the 6th Global TCI Conference held in Gothenburg, Sweden in September 2003. The purpose of this Greenbook was to give a summary of current practices in organising and implementing cluster initiatives around the world (Sölvell, et al, 2003). The Greenbook presents data from over 250 Cluster Initiatives around the world, based on Global Cluster Initiative Survey 2003 and a series of case studies.

illustrates both the concept of clusterpreneurs and their role in this specific initiative. In the last section we conclude with some indications for further research.

2 Actors in the emergence phase of cluster formation

The emergence of clusters has been studied intensively in recent years, primarily based upon historic case studies⁵. In general the explanations given may be grouped in three. One group of explanations emphasize that clusters are concentrations of resources. They are generating knowledge spill overs, draw upon a common pool of skilled labour and specialized intermediaries. Another group of explanations see clusters as emerging out of random seeding, accidental or deliberately generated positive expectations at an early stage. Finally, a third group of explanations see the internal dynamics as decisive and explore these by network analysis and industrial organisation studies.

Cluster studies tend to ignore to a large extent to specify the actors and relate these actors to the type of region in which they operate. Some studies do, though, emphasize the role of entrepreneurship. For example, Feldman (2001, et al 2005, Feldman and Francis, 2006) see entrepreneurs as key drivers in formation of clusters. However, this and most other studies in line with it, see the entrepreneur as an individual, private actor in the cluster dynamics, and their primary contribution is through establishing and running businesses. The conceptualisation of clusterpreneur below attempts to bring in the precise actor perspective and is different in approach from Feldman et al (2005) and others in that it does not assume static boundaries of the firm and it includes intrapreneurship as important in the dynamics of developing clusters, which is something broader than individuals starting up firms. Hence, in the understanding of entrepreneurship unfolded below is also the spin-off processes, the business developers within the firms and entrepreneurial activities in the public sector.

“Clusterpreneurs” have a crucial role to play in the cluster emerging process and may be seen as a constellation of four types of actors: 1) University and other research organisations, 2) Policy makers, 3) private firms and industry associations, 4) Business services and venture capital organisations⁶. These actors may in combinations compromise ‘clusterpreneurs’ and act with varying intensity of involvement and resources over time.

Although cluster initiatives may be started by e.g. local government, over time a broader set of actors usually becomes involved, and more importantly, clusterpreneurs may tie the different actors together. An important function of clusterpreneurs is thus to knit regional organisations together not

⁵ One exception is Brenner (2005).

⁶ Three of the actors: university/research, private firms/industry, and policy is well known and developed in the Triple Helix literature (e.g. Etzkovitz, 2000). We propose that a fourth element is important for cluster formation: Venture Capital and access to specialised services.

only in a physical sense by creating networks between these organisations but equally important is the institutional creation in terms of developing social capital. Sometimes it is one type of actor (e.g. a private person), sometimes a group of two or more of these four types who are active in doing so. The ‘Quadra Helix’ actors very often dominate and drive the cluster development asymmetrically. Their collaboration can be loose and informal, thus, it can be difficult to identify these kind of clusterpreneurs⁷, but it can also be formalised, for instance as a group/organisation devoted to the promotion of a given cluster (as BioMedCommunity in our case – see section 6). In the later stage of development, the formalised clusterpreneurs very often finance the activities of cluster initiatives by fees coming from the companies involved in the initiative.

2.1 The collective character and changing role of different actors

Clusterpreneurs are particularly relevant for emerging clusters or rather cluster initiatives. According to Sölwell et al. (2003) cluster initiatives are very often started by one person with a background in the cluster who takes the lead – a “clusterpreneur”. However, they also give examples of numerous actors involved in starting cluster initiatives such as policy organizations at different levels (national, regional, local), industry organizations or even a single industry leader⁸. It is also often underlined that the reliance on a single key individual can turn out to be a disadvantage, especially in later stages of cluster development (Raines, 2002). Our approach thus differs from that of Sölwell et al. in that we emphasize the group character of the actors.

In a dynamic perspective there may be different levels of involvement from the different types of actors over during the evolution of the cluster and in some clusters the roles of the single actor may differ from that of others. For example, in some cases policy may have a decisive role in the early phases of the cluster life cycle whereas policy may only be supportive in later stages in other clusters. The overall role of active clusterpreneurs may over time vary, most often diminish when the cluster grows and develop its’ own self-augmented processes and networks. Specifically, cluster development may imply that the roles of clusterpreneurs develop into self-organized processes rather than top-down governance. We contend that whereas the different parts of clusterpreneurs may be present it is not enough to develop a dynamic cluster development. The specific relationships between these factors may be more decisive than how much is there of a particular factor. Furthermore, we argue that whereas many studies see institutions as exogenous or lagging behind

⁷ Lorenzen (1998) find in a study of a Danish furniture cluster that key clusterpreneurs are to be found in local loge/club/Rotary where build-up of trust and mental coherence provides a basis for business collaboration.

⁸ Another example of emphasizing the role of the actors in cluster initiatives can be found in DTI (2004) “A Practical Guide to Cluster Development”. The authors of the Guide claim that the success of clusters may be often associated with strong leadership, either from individuals or institutions. They appreciate the function of industry leaders in removing obstacles, assisting in cultivating collaborations between cluster stakeholders, developing a vision and acting as “champions” for the future strategy of the cluster (DTI, 2004: 50).

perhaps even following cluster formation (Feldman et al., 2005) we see the clusterpreneurs as proactively forming cluster processes.

2.2 Collaboration between private and public actors

A further sub-division of types of clusterpreneurs can be applied: on the one hand private individuals and organizations that are devoted to promote local business through clustering and on the other hand regional government represented by government agencies and other public bodies. The differentiation between private and public types of actors is based upon the assertion that these two types may, at the same time, have some common and some divergent interests. Moreover, their activities are determined and controlled by different mechanisms and rationales. Private clusterpreneurs are motivated by the profit and image/reputation and network and spill over effects companies can get out from being agglomerated in a cluster, whereas in the case of public actors they are primarily interested in providing new jobs in the region.

Porter (1998) emphasizes that many clusters include governmental and other organisations – such as universities, standard-setting agencies, think tanks, vocational training providers, and trade associations – that provide specialized training, education, information, research and technical support. Porter suggests a new agenda of collective action in the private sector; that it is not only government's function to invest in public goods. Cluster thinking clearly demonstrates how companies benefit from local assets and institutions (e.g. trade associations establishing university-based testing facilities and training or research programs). Even if it seems obvious that private firms may at the aggregate, and in the long term, benefit from such investments, it involves a classic dilemma of free-riding as well as conflicting micro – macro objectives. Private sector investing in public goods has been claimed to be particularly problematic in the European Union in comparison to the United States (Cooke, 2001b). However, there are likely to be substantial intra-European differences at this point.⁹ Cluster building is often a joint effort of public and private sector action. The shared financing of the formalised clusterpreneurs' organizations seen widely as an example on how the clusterpreneurs' activities can trigger participation of private sector in public goods building, thus improving collective action.

⁹ This may be reflected in the large differences between European countries in the level of private investments in vocational training, an area also characterised by free-rider problems.

3 Cluster policies - the principle difficulties for cluster formation in the periphery/low-tech regions

As mentioned, cluster policy has become a central feature of economic policy in the last decade. Although cluster policy is being widely criticized by the academic world (Martin and Sunley, 2003), the fact is that it is extensively implemented by policy makers (OECD 1999, 2001). The rationale for innovation policy in general has traditionally referred to market failures, where price mechanisms fail to take externalities into account. In relation to cluster policies, the objective of policy then is to provide access to goods that the market fail to produce, specifically networks and coordination. Following the development of innovation thinking towards seeing innovation in a system perspective, innovation policies now increasingly refer to system failures rather than market failure. Such policies to alleviate system failures may address institutions and capabilities related to the interaction between key agents in the system. As such, this perspective is more adequate for cluster policies than the market failure perspective.

Moreover, cluster promotion is not only confined to urban areas even if clusters tend to concentrate in such areas.

Cluster promotion in a periphery region may, however, involve a series of additional challenges compared to those present in urban areas. First, these regions are generally characterised by the lack of developed physical infrastructure and social capital as mentioned in the introduction. Secondly, big companies that may play the role of driving forces/pull factors in the cluster formation process are often absent and difficult to attract. Rather, urban areas have been shown to attract high-tech/high innovative enterprises (Therrien, 2005). Thirdly, periphery regions lack also many other factors enabling emergence of clusters such as a critical mass of firms, a university and other knowledge institutions, venture capital and other financing sources and supporting business services. Fourthly, it may be argued that, local knowledge infrastructure and the ability to attract talented labour is crucial (Glaeser, 2003) in areas with low-tech specialization.

A low education level of the labour force is likewise often characteristic of the peripheral region. Moreover, low-tech regions generally often lack basic Marshallian agglomeration economies rendering external economies passed on to firms as a result of saving from large-scale operations of the agglomeration as a whole.

These factors are interconnected and very often the lack of just one of them is the reason why a cluster cannot be developed in the region and this makes active policy even more necessary. Therefore, clusterpreneurs are even more needed in these regions. It is, however, important to emphasize that the pure presence of these factors does not do the trick. Cooke (2001b) contends that

it is e.g. not the more readily available presence of Venture Capital and university bio-tech research that makes the US bio-tech industry outperform that of Europe, it is the system for commercialisation of the research, which is more efficient in the US. This emphasizes the importance of a systemic, integrated working of the clusterpreneurs, rather than just the presence of individual factors.

4 Cluster policies – content, challenges, dilemmas

4.1 Content of cluster policy

The role of policy in cluster development has been subject to many controversies. Porter has e.g. suggested active cluster policy. However, it seems to be a general perception in the literature that one cannot create clusters from scratch (Sternberg, 2003, Raines, 2002). Thus, Porter argues that targets for active policies should be only the clusters that proved sustainable, rather than trying to create completely new clusters (Porter, 1998a). The case (section 6) is an example of cluster policies going against the general assertion and Porter recommendation that active policies cannot create clusters.

The importance of clusters implies new roles for government at national and regional levels. In the global economy sound macroeconomic policies are necessary but not sufficient. Government's more decisive and inevitable influences are at the microeconomic level rather than at the macroeconomic level (Porter 2000). Cluster theory highlights the role of local actors (local/regional governments) in economic policy focused on upgrading innovation.

Cluster initiatives have developed as a new policy agenda, however it is often based on traditional policy areas such as regional policies, innovation policies and industry policy, and it is conducted vastly heterogeneously across countries and regions. A number of common characteristics for successful cluster initiatives such as investing in education, setting the rules of competition by establishing open market institutions, ensuring the physical infrastructure, motivating collective action by the private sector, tolerating and even encouraging multinationals, etc. (Gambardella *et al.* 2002) have been listed. Cluster policies are often associated with public initiatives and actors. However, there may also be private actors actively pursuing cluster policies, in Fromhold-Eisebith and Eisebith (2005) denoted top-down and bottom-up institutionalizations respectively.

An approach also somewhat more in line with the arguments in this paper is that of Keeble and Wilkinson (2000) who suggest the following measures (from Spilling and Steinsli, 2003)

“diffusion of knowledge from the science and technology base, for example by reducing barriers between industry and university by supporting technology consultants helping small firms to utilise knowledge from the university

support networking and collective learning processes by for instance supporting research collaboration between local SMEs

business support for high-technology SMEs, for instance through education and training facilities targeted at their specific needs and development

policies targeted to the specific needs on the regional level in order to develop policies targeting the specific challenges in each region.”

Tödtling and Trippel (2005) specifically emphasize the latter point. In addition to this we highlight the role of local actors (local governments, firms, universities), the clusterpreneurs. Another important content of cluster policy is the fact that it should support networking and collective learning processes among the local actors, especially SMEs and universities thus support the building of the social capital in the region, something that in later stages can be an important carrier of the cluster policy.

4.2 Choosing the right area – industry, sector, cluster

Inherently it is difficult to plan cluster formation based on innovation. The innovation process entails uncertainty, not only technical uncertainty, but also uncertainty on the market. Therefore, the paths of technological development is difficult to predict, as the existence of the vast literature on technology foresight illustrates. Planning clusters in this environment is extremely risky and uncertain.

Given that governments have a role in cluster development the policy makers are faced with a dilemma: clusters may emerge in several areas, and resources may be restricted. How then should one choose the right area to target and in the same time securing diversity that makes the region less vulnerable towards changes (narrow vs. broader focus)? Achievement of the necessary critical mass of firms in the chosen industry may cause the biggest problem.

This may be denoted a “policy dilemma” regional policy makers face when they, on the one hand, wish to promote such a cluster, but on the other hand they do not want to target policies too much towards benefiting certain sectors at the expense of others. Therefore it is important to see the two types of actors in clusters – regional policy bodies and private individuals/organisations – as mutually reinforcing and dependent upon each other. Particularly, the presence of private

clusterpreneurs may be convenient for local government to legitimise spending resources on specific sectors.

The specific instruments in cluster- and innovation policy are often disregarded in theoretical cluster studies partly due to the fact that they may vary with the particular case, in other words, a general model of cluster policy is likely to be inadequate (Nauwelaers, 2001, Raines, 2002, Martin and Sunley, 2003). Cluster policies need to be adjusted to the specific preconditions and strategy of the target region. At a more general level innovation- and cluster policy has moved in three phases from focus on physical capital such as infrastructure, R&D and finance to immaterial aspects related to human capital, such as knowledge, education and training and finally to social capital like networks, norms and institutions (Nauwelaers, 2001). This poses challenges to policy makers because the instruments of the latter types of policy are not very well developed and less measurable.

Another dilemma may be related to the above-mentioned network / social capital as the target for policy. The question is how to promote social capital with policy instruments. Traditional policy instruments quickly become inadequate. Inherently, it is not easy to enforce collaboration to people. It may be possible, though, to bring the parties together and see how the networks evolve. This, however, render another more passive role for policy agents, conflicting the perceived role for policy actors as being very active.

4.3 Rationale behind promotion of low labour intensive high-tech industries - time horizon

An additional problem may arise with the rationale behind promotion of high-tech industries that are usually not labour-intensive. In the case of periphery regions it is primarily unemployment that is the biggest problem for policy makers. This introduces a time perspective dilemma between short-term and long-term policy objectives. Although in the short-term, low-tech industries provide more work places in the region, they are more vulnerable to fluctuations on the regional, national and (maybe the most important), global level, e.g. moving production to low labour costs countries. On the other hand, promotion of high-tech industries or clusters involves structural change in the region, which is a long time process (Dalum et al., 1998). This may put a pressure on policy makers to stick to stimulating the existing industrial structure.

5 Specific difficulties in North Jutland (Denmark)

The North Jutland region has traditionally been characterized as peripheral with an unemployment rate among the highest in Denmark (about 1.7 percent above national average). The industrial profile of Aalborg (the capital city of the region) has been dominated by traditional labour intensive manufacturing industries while the other parts of the region have been dominated by the primary sector, especially agriculture and fishing, and in more recent decades, tourism. The regional specialization pattern for North Jutland shows that NJ is more specialized in primary industries and less specialised in finance and business services. Even if the region during the 1990s has experienced a partial process of structural change towards more growth-oriented industries (some parts of the region became specialized in machinery and equipment as well as electronics (Pedersen, 2005) the region can still be characterized as relatively low-tech/periphery in Denmark. Other indicators such as the education level show that the share of people with highest education is 1.5 times lower in North Jutland than in the whole Denmark. Similarly, the R&D level in the region weighted with the North Jutland's share of Danish firms, and the number of patents per 1000 inhabitants, is for North Jutland approximately 2/3 of Denmark's level.

The specific difficulties for promotion of high-tech cluster in North Jutland show that first and foremost the region is structurally different than the rest of Denmark. Changing that is a very long process that requires financial resources. In summation, the region exhibit many of the characteristics of a peripheral region within Denmark regardless if it may be more developed than many other regions in Europe.

6 The case of Biomedico in North Jutland

In this section we present the case of a Biomedico cluster initiative in North Jutland. We present the cluster initiative, its history and main actors and we put the case in its regional and institutional context. The case is presented to render insights on key characteristics of clusterpreneurs and cluster policies as discussed above. Clusterpreneurs very often consist of both public and private actors and especially the presence of the latter makes cluster policy more legitimised. Concerted action, where linkages between different actors are created through informal co-operation, is another important feature of clusterpreneurs. This action helps to overcome a main problem of periphery regions – lacking social capital and how to stimulate collective learning and collective action.

Formalisation of clusterpreneurs (e.g. in a form of an organisation), which can be a possible outcome and continuation of the concerted action, is an important step in clusterpreneurs' development enhancing the quality of the linkages between the actors and the synergy effect. Clusterpreneurs have a common vision of their cluster that is formulated in a strategy. It should be emphasised that

this common vision exists in spite of divergent interests of the actors involved in the cluster initiative, which are especially likely to be observed in the low-tech regions, where unemployment is very often the biggest concern of the public actors. Network policy plays an important role in clusterpreneurs' strategy. As we have mentioned before, it is not easy to enforce collaboration among people and it may be the most difficult part of cluster policy.

6.1 Cluster competences

From 2000 initiatives have been started in order to promote regional development in biomedical technology in North Jutland. One of the origins of this initiative may be the fact that on the national level the Danish government adopted a strategy for development of Biomedico industries as growth potentials from 2000 (*Regerings handlingsplan – Biomedico området, 2000*). Moreover, on the regional level the actors interested in local economic development while looking for new industry that could supplement or eventually replace the existing Mobile Telecommunications (ICT) cluster¹⁰ had noticed local biomedico strengths in biomedical area. The biomedical area is considered one of the most promising from the industrial development point of view in almost every European country, and it is thus naturally catching attention. What then, was the belief in another industrial stronghold based upon? The actors behind the cluster initiative had identified the following competences in the region that were thought to be decisive for a potential emergence of a cluster:

a) Aalborg University (AAU)

AAU established a substantial activity within Health Science & Technology, Medico-technology, Biotechnology, and related areas that may be overall termed Life Sciences. Research at AAU in this area has obtained international recognition. In some areas the research has a 20 years tradition. Particularly research within the medico-technical area at Centre for Sensory Motor Interaction (SMI¹¹) developed new methods for stimulating and treating electrical signals from muscles. Furthermore, new advanced methods were developed for measuring and activating the motoric system and for locating pain. Moreover, the university developed a centre for research within stem cell technology¹², where research is performed to determine how stem cells may be used to develop human spare parts. Another potential research field at AAU is biotechnology and the cluster initiative actors also see possibilities of synergy from substantial research in nanotechnology, although it seems that it is mainly within medico-technology where research is at the highest

¹⁰ In fact, it is explicitly expressed in interviews conducted by the authors that the ambition is to replicate the successful development of the ICT cluster. Policy had an important role in the later phase of the development of that cluster and policy makers in the region are aware that active policy may likewise be decisive for the Biomedico cluster.

¹¹ <http://www.smi.hst.aau.dk/>

¹² <http://www.hst.aau.dk/lsc/>

international level. In addition to a full study programme in biomedical engineering a doctoral school, which has approximately 50 Ph.D. scholarships at the same time, contributes to the high technological level of knowledge within the area. This school educates candidates at the international level within Biomedical Engineering that can be potential employers in the local industry. A recent (2007) initiative is the establishment of a medical engineering education.

b) Aalborg Hospital, Århus University Hospital

Aalborg Hospital has a tradition of co-operation with Aalborg University and Århus University. This co-operation is formalised in the HEALTHnTECH Research Centre (established in 2003), which offers support and evaluation of product ideas and applications developed by the industry. The close relations between doctors, scientists and commercial resources have resulted in the set-up of a few (approx. 5) spin-off companies.

c) Companies in the region/Industry

As already mentioned, the main high-tech companies in the region can be found within electronics and telecommunications. This sector is represented by big international companies¹³, but also many smaller companies that play an important role for the ICT cluster. In Biomedico technology there are approximately 35 companies whose profiles to a certain degree can be described as biomedical technology. These companies are mostly very small development companies employing 1-2 persons. Some of them are spin-offs from the university research and therefore they may rather be called development projects. Among these firms there are only 5 companies, which can be classified as biomedical production/manufacturing companies with employment over 10 persons. Another feature of the firms in this cluster is that the picture is very turbulent, some companies disappeared and new ones have been established. As mentioned in the description of hospital competences the health sector in Denmark is to a very large extent a public sector, which means that the local customers of the firms within medical technology are also public authorities. For promotion of this kind of cluster one may expect that in the Danish case the policy may be relatively more influential due to the large size of the health sector in Denmark, and related high public procurement and demand. We can conclude that within the biomedical area the region is characterised by lack of big companies and a very small number of small companies whose specialisation profile is very differentiated. However, it seems as if there are indeed seeds to a cluster formation.

¹³ During the evolution of this cluster international companies like Siemens, Motorola, L.M. Ericsson, Texas Instruments and Flextronics established subsidiaries in North Jutland as a part of the ICT cluster.

6.2 The Cluster initiative

The beginning of this cluster initiative can be dated back to 2000. It was the Aalborg Commercial Council¹⁴ that together with The Industrial Liaisons Office at Aalborg University started the initiative, and then other actors joined them, specifically North Jutland County, Aalborg municipality, and finally industry representatives. There was one person at The Industrial Liaisons Office that seems to be devoted to this initiative from the beginning.

The initiative was formalised by the actors mentioned above (Aalborg Commercial Council, the Industrial Liaisons Office) in 2003 when BioMed Community: Science & Innovation for the Living was established¹⁵. The BioMed Community is a co-operation that has the objective to develop and promote North Denmark's cluster within Life Sciences. The competence group represents the main actors in the region interested in this cluster initiative: Aalborg University, Aalborg Hospital, Biomedical companies, The County of North Denmark, Aalborg Commercial Council, and the Region Aalborg Cooperation, hence we have agents coming from University, Government, Industry and also representing Venture Capital/supporting services. The group is administrated by representatives of The Industrial Liaisons Office and Aalborg Commercial Council and financed by the public actors.

The status for the cluster may be described as struggling to take-off. Thus, according to the organisation, BioMedCommunity, the primary factors for a biomedico cluster is present in the region, such as research, education, networking, Venture Capital and health sector. The region is claimed to already be above the critical mass in these aspects. The small number of companies is regarded as a problem. Furthermore, it is quiet recently that the region's hospital was given the status of University Hospital and the clinical research history is not very long. What may be lacking is seen as a larger number of firms. It may also be argued, in line with the argumentation in the introduction, that the pure presence of these factors will not do the trick, they need to be related to each other and interwoven in network constellations that may productively use synergies. However, the BioMediCom organisation is aware of precisely these two problems and do take actions in relation to them, as explained in the next section.

Even if not a tangible institution one can argue that also the presence of another cluster-ICT cluster matters as a source of inspiration for the clusterpreneurs.

¹⁴ Aalborg Commercial Council provides the service to the more than 5,000 companies, including counselling of business establishment, financing, export, import, staff and management development, marketing, subsidies, and so on (Competence Catalogue).

¹⁵ www.biomedcom.dk

6.3 Actual policies in North Jutland towards promoting the Biomedico cluster

This section is for the most part based on the interviews with the actors involved in the initiative, representing the clusterpreneurs. Interviews were undertaken with a number of key persons, Appendix 1 list the interviewees and main headlines for the issues discussed.

Publishing promotion materials, marketing, attracting new firms to the region, promotion of new and established companies have been the main activities of BioMed Community in the first two years.

As mentioned above an increase in the number of firms is likely to spur a virtuous circle of cluster evolution, just as in the ICT-cluster, where firms were attracted to the region because of the presence of a number of key players in the industry (Stoerring and Dalum, 2008). Consequently efforts have been made to attract firms from outside as well as stimulate spin-offs and –outs. However, ‘soft factors’ were recognized as essential to the evolution of the cluster. Therefore, it is fair to say that the cluster initiative also took a more dynamic path after this period rendering the following actions:

In February 2003 a so-called “Firms club” has been established. It is a club for the companies from North Denmark (limited not only to North Jutland County: one of the biggest company is located in another (Ringkøbing) county). The co-operation in the club should establish synergy between companies in the region, especially that they learn about each other existence, identify and discuss common problems, influence their co-operation with the Liaisons Office and the hospital, so that it should be easier to support more efficiently the innovative activities within the industry. BioMedCommunity should support companies’ club with administration, organization and meeting facilities, finding capital, marketing, common participation at national and international exhibitions. The creators of the club plan to organize visiting companies, invite them to the university. The aim is to bring companies together and support their co-operation¹⁶.

The cluster initiative actors in their determination to develop industry in the cluster has mobilised considerable financial resources in the belief that dedicating more finances can speed up the process of cluster formation. These resources came from the North Jutland County, partly financed from the European Union funds. One of the first initiatives was establishment of Research House at Aalborg Hospital (Forskningens hus). This initiative originated from the HEALTHnTECH - co-operation and should prioritise an innovative part of this co-operation with emphasis on involving industry. They expect to have 10-15 research groups from the Hospital. In the Research House there will also be a room offered to establish a new company or a department that is closer to the hospital (e.g. for clinical testing). There is also an area dedicated to group rooms for students. The idea was to concentrate the innovation environment at one place: research, education and industry from both

¹⁶ According to the creators of the club: “the power is in the unity”.

Medicine studies from Aarhus University/Aalborg Hospital and Department for Health Science and Technology at Aalborg University.

3 persons were hired on a part-time basis to work with the initiative between 2003 and 2005: one start-ups consultant, one ambassador and a communication consultant. Their task and especially the task of the ambassador's was to attract companies from other part of Denmark and abroad e.g. by means of involving such companies in co-operation projects with research conducted in the region. The start-up consultant should support new companies (also offering the room in the Research House), provide advice for development of the existing ones, assist people in the Liaisons Office working with start-ups, and support the University start-up programme at the medical technology department. Also at Aalborg University an intensification of activities took place. At the Liaisons Office an additional person was hired to work with Biomedico. A more long-term effort was the establishment of a master education at AAU.

A substantial and increasing amount of resources have been allocated for this initiative. A key target for the initiative was to develop competencies. The competencies that have been identified have to be developed. People involved in the initiative tried to play a role of very active ambassadors in their networks through branding the cluster in Denmark and abroad to potential co-operation partners.

The clusterpreneurs are aware that "creation" of clusters is a long process that requires building up and maintaining contacts. They refer to the way the ICT cluster in the region emerged. They believe that only one (not necessarily big) significant company that wants to establish a subsidiary in Aalborg is needed to start the process - other firms might follow. They further believe that this initiative needs a comprehensive approach and that is why they work with Invest in Denmark, Ministry of Foreign Affairs. In essence, transferring competencies from the University and Hospital to the Industry and reaching a critical mass of companies is the main challenge to them.

The case of Biomedico cluster initiative is an example of the role of clusterpreneurs promoting high-tech clusters in low-tech regions, where conditions for cluster development is even more difficult than in metropolitan areas.

In the case we have a very young cluster initiative and determined action to promote the emergence of the cluster. According to the actors involved in the initiative they are aware of that the industry needs to be developed and they see the greatest challenge in transferring existing research competences to the companies and in attracting such firms from outside.

Our case illustrates the multiple character of clusterpreneurs as both representatives from University, Policy, and Industry are involved in the initiative. There is clearly a formalisation process going on spurred by the the clusterpreneurs. In particular establishing BioMedCommunity as an organisation

devoted to promotion of this cluster and later on creation of the “Firms club”. This cluster initiative is characterised by the concerted action of the clusterpreneurs (we can even talk about a collective action). We can actually observe evolution of this action, from the informal collaboration between university and hospital through establishing of HEALTHnTECH Research Centre to the founding of The Research House. Co-existence of different environments at the Research House: researchers and students from Aalborg University and Hospital, and prospective presence of increasing number of companies, should enhance collective learning in the cluster.

According to our expectations the cross-factorial character of clusterpreneurs gives legitimacy to the initiative that can overcome some of dilemmas connected with promotion of high-tech clusters in low-tech regions. Local society can be more prone to accept dedicating financial resources to Biomedico cluster if they see so many different actors believing in this cluster.

Clusterpreneurs are united by the common vision of a prospective Biomedico cluster in North Jutland in spite of the fact that they represent very different types of actors with divergent interests. This common vision is translated into a formalised strategy for the Biomedico cluster development¹⁷. The Biomedico cluster initiative in North Jutland uses the network policy as the main objective and instrument of the clusterpreneurs’ action. All activities at the Research House, appointment of the new consultants, and informal branding by the clusterpreneurs aim to build new contacts, particularly with the industry both within and outside the region. This is an important process of building social capital in the region.

Moreover, already established traditions for co-operation in North Jutland due to the presence of already existing ICT cluster made it easier to the clusterpreneurs to start a new cluster initiative.

7 Conclusions

This paper has presented and discussed the role of actors in cluster formation in different regional contexts. We use a term “clusterpreneurs” for important actors in cluster formation and emphasize their collective/group character. Thus Clusterpreneurs can involve 4 types of actors: 1) University and other research organisations, 2) Policy makers, 3) Private firms and industry associations, 4) Business services and venture capital organisations. The arguments were illustrated and confronted with a single case, the promotion of a Biomedico cluster in North Jutland. Our findings suggest that cluster policies in less favoured regions like that of North Jutland are facing substantial challenges. Several reports and studies have pointed to the instruments of cluster policies and the conditions for successful cluster development initiatives. However, we find that a deficiency in the literature is the

¹⁷ Strategi for udvikling af bio/medicokompetence klynge i Nordjylland med SWOT analyse (23.04.03)/ Strategy for development of bio/medico competence cluster in North Jutland with SWOT analyses (23.04.03).

lack of emphasis on the importance of social capital (that can be symbolised by the clusterpreneurs) and discussions on how this is stimulated. This perspective combined with the fact that less favoured regions often have disadvantages with respect to the structural setting in the region, e.g. employment structure, specialization pattern in the region, social and institutional structure, existing entrepreneurial traditions in the region, availability of venture capital, educational level, poses substantial problems for active cluster policies.

We further think that policies may also be restricted by need for legitimisation. This dilemma is especially present in the less favoured regions. We find that the cross-factorial character of clusterpreneurs makes cluster policy more legitimized: it gives legitimacy to cluster policy when actors involved in a Cluster Initiative come not only from the policy side but also include other agents such as private agents: firms' or university representatives as in the Biomedico case.

However, we found that our case may deviate from the usual picture of less favoured region. Although North Jutland has characteristics of less favoured region as far as structural indicators are concerned, the region possesses already some features atypical for LFRs: the presence of social capital and development of the tradition of concerted action that emerged with the previous successful development of another cluster. The challenge of promoting the cluster was taken up by clusterpreneurs with a will to replicate the past success. This rendered a mental and social proximity and agreements on common objectives reaching further than short-term unemployment problems in the region. It was stated in the introduction that often less developed regions lack social capital. Admittedly this one case is no proof of rejecting that assertion, but it does show that there is indeed exceptions.

However, our analysis points to some problems in promotion of the Biomedical technology cluster in the region, the main one being reaching a critical mass of firms. This critical mass of companies may be needed to be able to compete on the national and international level and to facilitate a take-off of interaction and synergy within the cluster (classic Marshallian agglomeration effects). In addition to the lack of critical mass the Biomedico cluster does not have one or more large firms, which may in the longer run could make the cluster more sustainable through spin-offs and a more stable competence base.

Our main conclusion with respect to embedding the Biomedico cluster in the peripheral NJ region is that in spite of having structural characteristics of a periphery, such as higher unemployment, lower share of university educated workers, lower R&D ratio, growth and income the North Jutland entails some important institutional features that are atypical for periphery regions. In particular there is a social capital and networks to draw upon, and there is a world class research at the local university,

which make up an important part of the competence base. Hence, together with active policy/clusterpreneurs, these institutional advantages may alleviate the traditional structural deficiencies related to less developed regions.

We also found in our case studies that history and context matters in another way. For further research, there are possibilities in studying whether the Danish social welfare model with extended publicly supported help for various disabilities require devices and instruments produced by firms in the cluster. This may be an important precondition for the way the cluster has developed so far and can evolve in the future. The fact that the commercialisation of research is not purely technology-push, but also to a large extent demand driven may be an important success factor for high-tech cluster development in general and for our case specifically.

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Annex 1

List of interviews:

Charlotte Villadsen, managing clerk at Industry Liaison Office at Aalborg University

Allan Næs Gjerding, office director at North Jutland County until April 2004

Ulla Christensen, responsible for Biomedico initiative at North Jutland County, especially for

the contacts with the hospital

Simon Eskildsen, graduate from the Institute of Health and Science Technology, research assistant involved in the university start-up company

Jens Haase, medical doctor in neurosurgery retired, presently professor at SMI, Aalborg University

Thomas Sinkjær, professor, head of SMI, key person for the development of medical technology at Aalborg University, Neurodan's founder

Egon Toft, medical doctor, cardiologist at Aalborg Hospital, also visiting professor at Aalborg University

Steven Rees, associate professor at the Centre for Model-based Decision Making at Aalborg University

Jeppe Vangsgaard, consultant at HealthandTEch Research Centre involved in Biomedico cluster promotion activities

Lasse Mogensen, consultant at HealthandTEch Research Centre employed until February 2005

Jens Luebeck Johansen, start-up consultant at HealthandTEch Research Centre, former administrative director at Neurodan

Jesper Nielsen, product development director at Neurodan

Morten Haugland, founder and scientific officer of Neurodan

Finn Allan Larsen, consultant at Aalborg Commercial Council responsible for Biomedico cluster initiative

Poul Ernst Rasmussen, Managing Director of NOVI A/S

Suni A Dalbø, Technology Transfer Office at Aalborg University